BUILDING ASSEMBLY SYSTEM AND METHOD

FIELD OF THE INVENTION

[0001] The present invention relates to assemblage construction, shipment and building construction, and, more particularly, to a method and system for design, prefabrication, shipping and construction of a building.

BACKGROUND

[0002] Prior to the invention, factory precut buildings have been shipped in kit form with loose pieces, lumber precuts and precut panels of sheathing and flooring. The loose and precut pieces arrive at a building site ready for assembly, without requiring measuring and cutting. However, the loose pieces must be unpacked and sorted. Then the loose pieces are assembled and constructed in a standard manner pertaining to on-site building construction. Prior to the invention, factory assembled roof trusses were available for shipment. However, the trusses are individual pieces that lack assemblage with framing members for walls and floors. Thus, the roof trusses need to be constructed onto load bearing walls, which consumes time and labor costs in significantly large amounts.

SUMMARY OF THE INVENTION

[0003] The invention is a method and system of prefabricated assemblages that are shipped to a building site for construction of a building.

[0004] The invention relates to a building frame wherein the function of design simplifies it to evolve from a configuration that is collapsible for shipment, and into an deployed configuration to provide a frame for a building.

[0005] A method according to the invention includes the steps of; designing a building frame to fit in one or more shipping containers, and collapsing the building frame to fit in the shipping containers. According to an embodiment of the invention, the invention includes the

step of transferring the collapsed building frame from containers to a building site where the building frame is constructed to make a building.

[0006] There is considerable cost advantage obtained by the invention, by prefabricating the building frame initially as one or more assemblages in a geographical location where material and labor costs are low, and shipping corresponding building frame assemblages by sea container to a region of the world where buildings and their construction costs are expensive.

[0007] The invention fulfills a considerable need for one or more buildings constructed over water or uneven terrain, and constructed at resort regions experiencing hurricane force winds in the tropics, or heavy snowfall in mountainous elevations, and/or high seismic activity.

[0008] The invention further includes a method of constructing a building frame that has been collapsed for shipment in corresponding shipping containers, by removing the building frame from the corresponding shipping containers, and transferring the collapsed building frame to an un-collapsed configuration, and onto a building site to provide a frame for a building.

[0009] Embodiments of the invention will be described by way of example with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1A is an isometric view of a building frame for a building.

[0011] FIG. 1B is an elevation view of a building frame with parts separated from one another.

[0012] FIG. 1C is a perspective view of frame assemblages of the building frame disclosed by Fig. 1B.

[0013] FIG. 1D is an isometric view of a hinge connection for a frame assemblage.

)01] FIG. 1E is an elevation view of another embodiment of a building frame with parts separated from one another.

[0014] FIG. 1F is an elevation view of another embodiment of a building frame with parts separated from one another.

[0015] FIG. 1G is an elevation view of another embodiment of a building frame with parts separated from one another.

[0016] FIG. 1H is an elevation view of another embodiment of a building frame with parts separated from one another.

[0017] FIG. 1I is an isometric view of a hinge connection for a frame assemblage.

[0018] FIG. 2A is an isometric view of a shipping container and frame assemblages.

[0019] FIGS. 2B-2D are isometric views of first story frame assemblages being folded or collapsed and unfolded or constructed.

[0020] FIGS. 2E-2G are isometric views of second story frame assemblages being folded or collapsed and unfolded or constructed.

[0021] FIGS. 2H-2J are isometric views of roof truss frame assemblages being folded or collapsed and unfolded or constructed.

[0022] FIG. 2K is an isometric view of an embodiment of a foundation.

[0023] FIG. 3A is an isometric view of a subassembly prior to construction of a floor.

[0024] FIG. 3B is an isometric view of a subassembly constructed with a floor.

[0025] FIG. 3C is an isometric view of a permanent building site and construction of subassemblies.

[0026] FIG. 3D is an isometric view of a temporary building site and a crane, together with the permanent building site and subassemblies as disclosed by Fig. 3C.

[0027] FIG 4 is a diagrammatic view of a method of constructing a building using a crane and a temporary building site and at least one permanent building site.

[0028] FIG. 5 is an isometric view of a hollow, box beam, steel construction and systems contained therein.

[0029] FIGS. 6A-6G are isometric views of an embodiment of the invention designed for one crane pick.

DETAILED DESCRIPTION

[0030] This description of the exemplary embodiments is intended to be read in connection with the accompanying drawings, which are to be considered part of the entire written description. In the description, relative terms such as "lower," "upper," “horizontal,” “vertical,”, “above,” “below,” “up,” “down,” “top” and “bottom” as well as derivative thereof (e.g., “horizontally,” “downwardly,” “upwardly,” etc.) should be construed to refer to the orientation as then described or as shown in the drawing under discussion. These relative terms are for convenience of description and do not require that the apparatus be constructed or operated in a particular orientation. Terms concerning attachments, coupling and the like, such as “connected” and “interconnected,” refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise.

[0031] Fig. 1A discloses a constructed frame (100) for a building (102). The frame (100) is constructed with modular, prefabricated frame assemblages. Fig. 1B and Fig. 1C disclose a hinged pair of first story frame assemblages (104) and a hinged pair of second story frame assemblages (200) and a hinged pair of second story roof frame assemblages (300).

[0032] With reference to Fig. 1B, a hinged pair of modular, prefabricated first story frame assemblages (104) will now be described. The assemblages (104) are hinged together at the axis (120). Each modular, first story frame assemblage (104) has coplanar frame elements extending in the same vertical plane. The frame elements of each assemblage (104) include, an horizontal, first story floor girder (106), or floor joist plate, extending lengthwise from a horizontal, first story floor truss (108) that extends lengthwise of the floor girder (106). The truss (108) has diagonal brace elements (110) and vertical brace elements (112). The brace elements

(110) and (112) are connected between spaced apart beams formed by, a portion of the floor girder (106) and a horizontal, vertically offset floor girder (114).

[0033] Fig. 1B discloses an embodiment of the invention, wherein the truss (108) is an interior elevated floor truss (108). Fig. 1E and Fig. 1F disclose embodiments of the invention, wherein the truss (108) is an exterior, non-elevated floor truss (108). The length and vertical dimensions of the truss (108) are variable, depending on the floor load capacity desired, and/or the square footage to be supported by the truss (108). For example, each of the floor girder (106) and the truss (108) supports a floor load of 100 pounds per square foot. To support equal floor loads, the truss (108) weighs less, and/or can have a taller height than that of a beam such as the floor girder (106).

[0034] In one embodiment of the invention, the truss (108) extends from a central axis (120) to a first post (116). In an alternative construction the truss (108) extends from the central location, and between the first post (116) and a second post (118). Thus, different combinations of floor loads and square footage are constructed by different length combinations of the first story floor girder (106) and the first story floor truss (108). Further, configurations of different first story floor elevations are constructed by having an elevated truss (108), and further, by having an elevated truss (108) of different lengths.

[0035] Each first story frame assemblage (104) is of post and beam construction having the floor girder (106) supporting a vertical first post (116) and a vertical second post (118). The girders (106) and (114), and the posts (116) and (118), are beams, including, and not limited to; box beams, I-beams, H-beams, and beams of varying cross sectional shapes. The beams are constructed of materials, including, and not limited to; steel, aluminum, wood, plastics, and composites having fibers, strands and agglomerates. Exposed surfaces of the girders (106) and (114), and the posts (116) and (118) are prefinished, for example, with a veneer of laminated bamboo. The vertical posts (116) and (118) are to be supported by the girder (106) when the frame assemblage (104) is constructed at a temporary or permanent building site. The posts (116) and (118) are either prefabricated with the frame assemblage (104), or are precut members for installation with the frame assemblage (104) at the building site. According to an embodiment of the invention, the posts (116) and (118) are pivotally attached to the corresponding girders (106)

and (108) to collapse or fold, vertically, for packaging in a shipping container. According to another embodiment of the invention, the posts (116) and (118) are loose piece subassemblies for packaging in a shipping container. According to another embodiment of the invention the posts (116) and (118) are prefabricated by being joined and secured to the respective girders (106) and (108) by industry standard, steel construction gussets or by welding. For example, gussets and the box beams connect by, first, aligning bolt receiving openings through the gussets and the box beams, and then inserting threaded bolts through the aligned bolt receiving openings.

[0036] Each of Fig. 1A, Fig. 1B and Fig. 1E discloses an embodiment of the invention having an alternative construction of diagonal knees (122) joined to either the first post (116), or the second post (118).

[0037] With reference to Fig. 1C, a hinged pair of modular, prefabricated second story frame assemblages (200) will now be described. The assemblages (200) are hinged together at the axis (120). Each second story assemblage (200) has coplanar frame elements extending in the same vertical plane. The frame elements of each assemblage (200) include, a horizontal second story floor girder (202) or floor joist plate extending from the central axis (120) to align vertically over the second post (118). The girder (202) supports a first story roof rafter (206). The rafter (206) extends at an upward slope, for example, 15 degrees. The frame assemblage (200) further includes, a second story post (204) for vertical alignment with the post (116). The assemblage (200) is of post and beam construction. For example, the girder (202), the post (204) and rafter (206) are of hollow, box beam, steel construction. Exposed surfaces of the girder (202), the post (204) and rafter (206) are prefinished, for example, prefinished with a veneer of laminated bamboo.

[0038] The vertical post (204) is to be supported by the girder (202) when the frame assemblage (200) is constructed at a temporary or permanent building site. The post (204) is either prefabricated with the frame assemblage (200), or is a precut member for installation with the frame assemblage (200) at the building site. According to an embodiment of the invention, the prefabricated post (204) is pivotally attached to the corresponding girder (202) to pivot in the direction of the arrow (204a), and to collapse or fold, vertically, for packaging in a shipping container. According to another embodiment of the invention, the post (204) is a loose piece

subassembly for packaging in a shipping container. According to another embodiment of the invention the post (204) is prefabricated by being joined and secured to the respective girder (202) by industry standard, steel construction gussets or by welding.

[0039] Fig. 1H discloses another embodiment in which the frame assemblage (104) and the frame assemblage (200) provide a first story cantilever deck that is uncovered. The post (116) and the rafter (206) are eliminated from respective assemblages (104) and (200). The girder (202) is shortened.

[0040] With reference to Fig. 1C, a pair of modular, prefabricated frame assemblages (300) will now be described. The assemblages (300) are hinged together at the axis (120). Each assemblage (300) serves as a roof truss assemblage, and has coplanar frame elements extending in the same vertical plane. The frame elements of each assemblage (300) include, a horizontal, purlin that serves as a second story ceiling girder (302) or ceiling joist plate extending from the central axis (120) to align vertically over the post (204). The purlin or girder (302) supports a second story roof rafter (304). The rafter (304) extends at an upward slope, for example, 15 degrees. An alternative embodiment of the frame assemblage (300) further includes, a diagonal strut (306) extending between the rafter (304) and the purlin or girder (302). For example, the frame assemblage (300) is of hollow box beam steel construction. The strut (306), if present, is supported by the girder (302) and the rafter (304) when the frame assemblage (300) is constructed at a temporary or permanent building site. The girder (302) and the strut (306) are either prefabricated with the frame assemblage (300), or are precut members for installation with the frame assemblage (300) at the building site. When prefabricated, the girder (302) and/or the strut (306) are pivotally secured to the rafter (304), such that they collapse or fold, vertically, into a compact space for fitting in a container (400).

[0041] Fig. 1D discloses that each pair of frame assemblages (104) have steel hinge connections (124) at their inner ends at the axis (120) for connecting the frame assemblages (104) in hinged pairs. The hinge connections (124) allow the assemblages (104) to pivot toward each other and fold together, side by side for packaging in an industry standard container (400) for shipping. Fig. 2A discloses a container (400). The combined overall length of the floor girder (106) and floor truss (108) fits within a standard ocean freight shipping container (400).

According to an embodiment of the invention, the post (116), if present in a prefabricated assemblage (104), is hinged to the truss (108) to pivot in the direction of either of the arrows (116a), and to collapse or fold, vertically, into a compact space for fitting within a container (400). According to an embodiment of the invention, the post (118), if present in a prefabricated assemblage (104), is hinged to the girder (106) to pivot in the direction of the arrow (118a) to collapse or fold vertically, into a compact space for fitting within a container (400). Subsequently, the assemblages (104) are removed from a container (400) and are unfolded, by being pivoted apart, laterally, or horizontally, in preparation for construction on a temporary or permanent building site. The assemblages (104) are removed vertically from the container (400) through a vertical opening (402) of the container (400), or alternatively, the assemblages (104) are removed laterally from the container (400) through a lateral opening (404) of the container (400).

[0042] Fig. 2B discloses three pairs of assemblages (104) that are folded laterally, or horizontally, into a compact space for packaging and shipment in a container (400). Fig. 2C discloses one of the three pairs pivoted about the axis (120). Fig. 2D discloses the three pairs of assemblages (102) shown unfolded about an axis (120) to form a first story frame (100) for an exemplary version of the building (102).

[0043] Each pair of respective frame assemblages (200) and (300) has corresponding steel hinge connections (124) at their inner ends at the axis (120) for connecting the respective frame assemblages (200) and (300) in hinged pairs. Fig. 1I discloses the hinge connections (124) on the pair of assemblages (200), which are similar for the hinge connections (124) on the pair of assemblages (300). The hinge connections (124) allow the assemblages (200) and (300) to pivot laterally, or horizontally, toward each other and fold together, side by side for packaging in an industry standard container (400) for shipping. According to an embodiment of the invention, the post (204), if present in a prefabricated assemblage (200), is hinged to the girder (202) to pivot in the direction of the arrow (204a), and to collapse or fold, vertically, into a compact space for fitting within a container (400). Subsequently, the assemblages (200) and (300) are removed from a container (400) and are unfolded, by being pivoted apart, for construction on a temporary or permanent building site.

[0044] Fig. 2E discloses three pairs of assemblages (200) that are collapsed or folded, laterally, or horizontally, into a compact space for packaging and shipment. A crane is used to hoist, i.e., vertically remove the assemblages (200) from a container (400) and to transfer the assemblages (200) to a building site. Fig. 2F discloses one of the three pairs pivoted about the axis (120). Fig. 2G discloses the three pairs of assemblages (200) shown unfolded about an axis (120) to form a second story frame (100) for an exemplary version of the building (102).

[0045] Fig. 2H discloses three pairs of assemblages (300) that are collapsed, or folded, laterally, or horizontally, into a compact space for packaging and shipment in a container (400). A crane is used to hoist, i.e., vertically, or laterally, remove the assemblages (300) relative to a container (400) and to transfer the assemblages (300) to a building site. Fig. 2I discloses one of the three pairs pivoted about the axis (120). Fig. 2D discloses the three pairs of assemblages (102) shown unfolded about an axis (120) to form a second story roof truss of the frame (100) for an exemplary version of the building (102).

[0046] It is preferred to have the frame assemblages (104), (200) and (300) arranged in containers (400) in the order in which they would be removed relative to respective containers (400) by a crane. The containers (400) are transported by sea, and then by land, involving transfer of containers (400) from a ship to a truck that delivers the containers (400) as close as possible to the building site, where a crane removes the frame assemblages (104), (200) and (300) vertically, or alternatively, laterally, with respect to their containers (400) in the reverse order in which the frame assemblages (104), (200) and (300) were packaged in the containers (400). The frame assemblages (104), (200) and (300) are removed from containers (400) in the order in which they are assembled on site, i.e., on the building site, which can be a temporary building site or a permanent building site.

[0047] A crane refers to any industrial lifting apparatus capable of lifting a structure of about 8 tons overhead, which includes, and is not limited to, an industrial ginpole and a block and tackle lifting device.

[0048] An embodiment of a foundation (500) for the building (102) is shown in Fig. 1A at grade level, which requires only a conventional basement or a concrete pad supported on a buried footer. Each of Figs. 1B, 1E, 1F, 1G and 1H discloses an embodiment of a foundation

(500) provided by multiple, elevated pilings (500a) or columns, which are useful for providing a permanent building site elevated over water or over terrain that is uneven or sloped. The pilings (500a) are sunken in the earth or supported on an industry recognized, buried concrete footer. The depth of the pilings (500a) or footer is sufficient to resist sinking under the weight of the building (102) and to resist heaving by freezing and thawing cycles, and to resist tidal and storm waves, and seismic activity, which ever is appropriate for the building site. The assemblages (104) of the first story girder (106) and truss (108), are self-supporting with minimum deflection when cantilever supported on pilings or columns (500a).

[0049] Fig. 2K discloses an embodiment of a foundation (500) wherein elevated walls (500b) provide the foundation (500) as a modification of the pilings (500a) or columns. The walls (500b) can join one another and form an enclosure for a utilities closet for the building (102). A door opening (502) is provided through one of the walls (500b). The walls (500b) are supported on buried pilings or on a buried footer. For example, the walls (500b) are steel reinforced concrete, adapted to be joined to the first story frame assemblages (104) with industry standard gussets (506). In an embodiment, the walls (500b) have optional notches (504) for registration with respective first story floor girders (106). The assemblages (104) of the first story girder (106) and truss (108), are self-supporting with minimum deflection when cantilever supported on the elevated walls (500b) of the enclosure.

[0050] Fig. 3A discloses a hinged pair of first floor frame assemblages (104) which have been constructed on a building site, for example, a temporary building site. The pair is or hoisted by a crane to the building site. The pair of assemblages (104) is unfolded by workmen at the building site, where a perimeter beam or floor girder (600) is installed, and floor joists (602) are installed, and a knee wall (604) is installed. Then, as disclosed by Fig. 3B, flooring is installed over the joists (602) to provide a portion of a first story floor (608). An elevated, stepped floor level is supported on the knee wall (604) and the trusses (108). Thus, a subassembly (610) is constructed on a building site that is either a temporary building site or permanent building site that has one form of the foundation (500).

[0051] When the building site is a temporary building site, the subassembly (610) is hoisted or lifted by the crane and transferred to a permanent building site, where it is lowered by

the crane, and is attached by workers to one or another embodiment of the foundations (500). Thereby, the subassembly (610) is erected or constructed at the permanent building site. The subassembly (610) is joined and secured by industry standard gussets or by welding. Following construction of the first subassembly (600) the construction process disclosed by Figs. 3A and 3B is repeated. According to an embodiment of the invention, six subassemblies (610) are constructed, making a complete first story portion of the frame (100) having a complete first story floor (608) that is constructed at a permanent building site.

[0052] Fig. 3C discloses another embodiment of the invention wherein of the assemblages (104) has a prefabricated perimeter beam or floor girder (600a) hinged to floor girders (104) and prefabricated knee walls (604a). For example, each prefabricated perimeter beam (600a) is of hollow, box beam construction, and is hinged to an assemblage (104), as shown in Fig. 3C, by a hinge connection similar to the hinge connection (120) disclosed by Fig. 1I. For example, each prefabricated knee wall (604a) is a steel construction truss, and is hinged to an assemblage (104), as shown in Fig. C., by a hinge connection similar to the hinge connection (124) as disclosed by Fig. 1D. One of the prefabricated floor girders (600a) and one of the prefabricated knee walls (604a) is a platform on which to construct a floor (608), in the manner discussed with respect to Figs. 3A and 3B. A second floor girder (600a) and a second knee wall (604a) are available for further construction, as will now be discussed with reference to Figs. 3C and 3D.

[0053] Fig. 3D discloses a crane (702) in the process of transferring a subassembly (610) from a temporary building site (700) to a permanent building site. Both the temporary building site (700) and the permanent building site are anywhere within the cane's perimeter reach (704). Further, Fig. 3D discloses a pair of assemblies (610) having floors (608) erected or constructed at the permanent building site. The subassembly (610) being transferred by the crane (702) has a second perimeter beam (600a) and a second knee wall (604a) that are pivotable outward to be used to construct an adjacent subassembly (610a) at the permanent building site. Figs. 3C and 3D disclose such a subassembly (600a) that was previously constructed. According to this embodiment of the invention, two subassemblies (610) having floors (608) are constructed according to the process disclosed by Figs. 3A and 3B. Then the two subassemblies (610) are transferred, for example, by the crane (702) to the permanent building site disclosed by Figs. 3C

and 3D. The second perimeter beam (600a) and the second knee wall (604a) are pivoted to bridge between the two subassemblies (610) that have been erected or constructed previously at the permanent building site of Fig. 3C. The second perimeter beam (600a) and the second knee wall (604a) are used to construct another, third subassembly (610a) between the two erected subassemblies (610). The construction process disclosed by Figs. 3A, 3B, 3C and 3D are repeated to build a completed first story floor (608) and a first story portion of the frame (100).

[0054] Fig. 4 discloses a temporary building site (700) together with a crane (702) having a perimeter reach (704). When the building site is a temporary building site (700), a crane (702) transfers the two subassemblies (610) to the permanent building site of Fig. 3C. At a permanent building site, the two subassemblies (610) contribute a second perimeter beam or floor girder (600a) and a second knee wall (604a) to build a third subassembly (610a) at the permanent building site of Fig. 3C. The construction process is repeated, until adjacent subassemblies (610) are joined to each other by a perimeter floor girder (600a) that spans between the adjacent subassemblies (610), followed by construction of floor joists or purlins (602) spanning between the adjacent subassemblies (610), followed by an installed floor, similar to the floor (608), making a complete first story frame (100) constructed at a permanent building site, with a complete first story floor. Alternatively, six subassemblies (610), as disclosed by Fig. 3B, are constructed at the permanent building site, making a complete first story frame (100) constructed at a permanent building site, with a complete first story floor (608).

[0055] Although the construction process is described with reference to a temporary building site (700), either a temporary building site (700) or a permanent building site is within the scope of the invention. The construction process that is described herein as being performed at a temporary building site, may be performed at a permanent building site.

[0056] Thus, each hinged pair of first story frame assemblages (104) has a perimeter floor girder (600). The perimeter floor girder (600) is attached by a hinge connection (124) to a first story girder (106) for pivoting side by side with the hinged pair of first story frame assemblages (104). When constructed at a permanent or temporary building site the perimeter floor girder (600) is pivoted out to bridge between the corresponding pair of first story frame assemblages (104).

[0057] Further, each subassembly (610) that is made from a hinged pair of first story frame assemblages (104) has a perimeter floor girder (600a). The perimeter floor girder (600a) is attached by a hinge connection (124) to a first story girder (106) for pivoting side by side with the hinged pair of first story frame assemblages (104) for fitting in a compact space for shipment in a container (400). When constructed at a building site the perimeter floor girder (600a) is pivoted out to bridge from one pair of first story frame assemblages (104) to another pair.

[0058] Following construction of the first story frame assemblages (104) with a floor (608) at the permanent building site, a pair of second story frame assemblages (200) is installed by the crane (702) onto the constructed pair of first story frame assemblages (104). The crane (702) lifts or hoists the second story frame assemblages (200) and sets them on the first story frame assemblages (104). Workers then attach the second story frame assemblages (200) to the first story frame assemblages (104) and to the mast (208) by industry standard gussets or by welding.

[0059] Fig. 4 discloses a temporary building site (700) that includes, and is not limited to, a platform, a pier, a water floating barge, or a land based barge, or a clearing on the ground, which allows construction of a subassembly (610) within reach of the crane (702), within the perimeter (704), and which allows the crane (602) to lift or hoist the subassembly (610), and to transport and transfer the subassembly (610) to a permanent building site (706). For example, the permanent building site (706) includes, and is not limited to, a foundation (500) in the form of previously described pilings (500a) that have been constructed over water or over uneven terrain at the permanent building site (706). The advantage of the invention, is that the crane (702) is within reach of multiple permanent building sites (706), using a single temporary building site (700). Another advantage of the invention is the capability of constructing one or more buildings (102) on permanent building sites (706) without the need for either or both, graded road, or site finish grading of the building sites (700) and/or (706).

[0060] According to an embodiment of the invention, the second story frame assemblages (104) and (200) and (300) are removed by the crane (702) from a corresponding shipping container (400), and are constructed at a temporary building site (700). Alternatively, one or more, or all of the first story frame assemblages (104) are constructed at the permanent

building site (706) before constructing the second story frame assemblages (200) onto the first story frame assemblages. Alternatively, one or more, or all of the second story frame assemblages (200) are constructed at the permanent building site (706) before constructing the second story roof truss assemblages (300) onto the second story frame assemblages (200).

[0061] The second story assemblages (200) are removed from a container (400) and are unfolded, by being pivoted apart, for construction on a temporary or permanent building site. For example, at a permanent building site (706), each hinged pair of assemblages (200) are constructed on a previously constructed pair of first story frame assemblages (104). According to an embodiment of the invention, as disclosed by Figs. 1A, 1B and 1E, the second story, floor girder (206) is supported from below on a diagonal knee (122) that diagonally bridges between the girder (206) and a corresponding post (116) or (118). When the second story frame assemblages (200) are constructed, each girder (206) is joined to a second story mast (208), or bearing load column, Figs. 1B, and 1H, of a construction including, and not limited to; a box beam, I-beam, H-beam, and a beam of varying cross sectional shape. The beam is constructed of materials, including, and not limited to; steel, aluminum, wood, plastics, and composites having fibers, strands and agglomerates. The assemblages (200) are secured to the assemblages (140) and the mast (208) by industry standard gussets or by welding.

[0062] Subsequently, the assemblages (300) are removed from a container (400) and are unfolded, by being pivoted apart, for construction on a temporary or permanent building site. For example, at a permanent building site)706), each hinged pair of assemblages (300)are constructed on a previously constructed pair of second story assemblages (200). Each rafter (304) and each purlin (302) are joined to the second story mast (208). The assemblages (300) are secured to the assemblages (200) and the mast (208) by industry standard gussets or by welding.

[0063] A method according to the invention includes the steps of; designing a building frame (100) to fit in one or more shipping containers (400), and collapsing the building frame (100) laterally (horizontally), or vertically, or both laterally and vertically, to fit in the shipping containers (400), and transferring the collapsed building frame (100) from containers (400) to a building site where the building frame (100) is constructed to make a building.

[0064] There is considerable cost advantage obtained by the invention, by prefabricating the building frame assemblages (104), (200) and (300) in a geographical location, including, but not limited to, Africa, China, Mexico and South America, where material and labor costs are low, and shipping the building frame assemblages (104), (200) and (300) by sea container to a region of the world where buildings and their construction costs are expensive.

[0065] The invention fulfills a considerable need for one or more buildings (102) constructed over water or uneven terrain, and constructed at resort regions experiencing hurricane force winds in the tropics, high seismic activity, or heavy snowfall in mountainous elevations.

[0066] The invention further includes a method of constructing a building frame (100) packaged for shipping container shipment, by removing the building frame (100) from the corresponding shipping container (400), and transferring the folded building frame (100) to an unfolded configuration, and onto a building site in an unfolded configuration.

[0067] As disclosed by Fig. 5, the hollow box beam construction (800) is a rugged, crush and bending resistant, fire proof conduit for containing point-to-point systems for power distribution, media and data communications and HVAC (heating, ventilation and air conditioning) systems, including, but not limited to, electrical power wiring (802), for example, multiple wire Romex plus ground, Ethernet communications wiring (804), broadband communications wiring (806), optical fiber communications cables (808), security systems cabling, water, water sprinkler system pipes and vent plumbing pipes (810) and HVAC air plenums (812). The structural elements exposed to view from the interior of the building are of steel hollow box beam construction, and are covered by a decorative surface finish, for example, exposed bamboo laminate.

[0068] Further, the hollow box beam construction (800) is a rugged conduit for tensioning cables that become part of the building, and for guy ropes and cables that are temporarily used for hauling and lashing when assembling and constructing the structural elements. These point-to-point systems are installed inside the hollow structural elements of the frame (100), and thus, are protected during shipment and handling. It is important to have as many point-to-point systems installed, and as much decorative finish work installed and

prefabricated, before shipment of the structural elements, to tailor the building frame assemblages (104), (200) and (300) for factory fabrication, instead of field fabrication, and to tailor the building frame assemblages (104), (200) and (300) for fabrication at a selected region where labor costs are low, when viewed on a world wide, country-by-country basis. Then the building frame assemblages (104), (200) and (300) can be shipped and constructed at a final building site (700) or (706), where fabrication of the assemblages is not as affordable and/or where the building site (706) is anything but dry, level land.

[0069] The building frame (100) is ready for assembly of walls and roofing. The walls and roofing do not require the point-to-point systems installed in them, prior to being sealed and/or covered with finishing materials. Thus, the walls and roofing are easily modular in form and construction to facilitate their installation on the frame (100).

[0070] Fig. 6A discloses another embodiment of a preassembled, frame (100a) having frame assemblages (104a) of hollow box beam, steel construction. The frame (100a) is designed for a single crane pull, or one crane pull. For example, the frame (100a) as disclosed by Figs. 6A and 6B is of one piece that is collapsed, or folded, to fit in a single container (400). The frame (100a) is inserted in the corresponding container (400) and is removed from the container (400) by a single hoist by a crane, for example, the crane (702). In Fig. 6A, the frame (100a) is removed from an open end of the container (400). In Fig. 6B, the frame (100a) is removed from an open top of the container (400).

[0071] Fig. 6C discloses the frame (100a) being lowered on a permanent building site. For example, the crane (702) lowers the frame (100a) onto one form of the foundation (500) that has vertical projecting pilings (55a) or columns, in turn, having the previously described notches (504). Alternatively, any other form of the foundation (500) is intended for use with the frame (100a).

[0072] Fig. 6D-6G disclose an embodiment of the frame (100) having hinged pairs of frame assemblages (104a) that are preassembled as a complete frame (100), prior to being inserted in a corresponding container (400). With reference to Fig. 6G, each of the assemblages (104a) is of hollow, box beam, steel construction. Each of the assemblages (104a) has a floor girder (106a) and a post (118a) and an inclined roof rafter (206a), secured, end to end, with

corresponding hinge connections similar to the hinge connection (124) for pivoting to collapse, or to fold, in the same vertical plane. A diagonal knee (122a) of hollow, box beam, steel construction pivotally secures to a corresponding girder (106a) by a hinge connection similar to the hinge connection (124). Each floor girder (106a) has a hinge connection (124) with a corresponding first central hollow sleeve beam (126). Each rafter (206a) has a hinge connection (124) with a corresponding second central hollow sleeve beam (128). When fully collapsed or fully folded, the floor girder (106a) and post (118a) of each assemblage (104a) collapse or fold end-to-end, and in the same plane. The knee (122a) pivots to extend against a corresponding girder (106a) in the same plane with the corresponding girder (106a).

[0073] The assemblages (104a) are collapsed or folded to a compact space. The order of collapse or order of folding is disclosed in the sequence of drawing figures, Fig. 6G, Fig. 6F, Fig. 6E, Fig. 6D and Fig. 6C. When fully collapsed or fully folded, the floor girders (106a) and posts (118a) collapse or fold inwardly toward the first sleeve beam (126). The rafters (206a) of the assemblages (104a) collapse or fold inwardly toward the second sleeve beam (128). Since all of the assemblages (104a) are preassembled to the first sleeve beam (126) and the second sleeve beam (128), a single hoist by the crane, or single crane pick, transfers the assemblages (104a) while in a fully collapsed or fully folded state to a corresponding container (400).

[0074] A single crane pick removes the assemblages (104a) from a corresponding container (400) and lowers the assemblages (104a) to the permanent building site, as disclosed by Fig. 6C. At the building site, the assemblages (104a) unfold according to the sequence disclosed by Fig. 6C, Fig. 6D, Fig. 6E, Fig. 6F and Fig. 6G. Further, Fig. 6G discloses the knees (122a) connected by industry standard steel construction gussets, or by welding, to the foundation (500) comprised of the pilings (55a).

[0075] The invention provides a building frame wherein, the function of design simplifies it to evolve into an un-collapsed configuration, and onto a building site. The invention provides an assemblage, and to its construction, shipment and building construction, with particular emphasis on a method and system for its design, prefabrication, shipping and construction.

[0076] Although the invention has been described in terms of exemplary embodiments, it is not limited thereto. Rather, the appended claims should be construed broadly, to include other variants and embodiments of the invention, which may be made by those skilled in the art without departing from the scope and range of equivalents of the invention.